1.0 A-Train Integrated CALIPSO, CloudSat, CERES, MODIS merged product (CCCM, C3M)

The a-train integrated CALIPSO, CloudSat, CERES, and MODIS merged product (CCCM) contains instantaneous retrieved cloud and aerosol properties from CALIPSO, CloudSat and MODIS over their ground track through near nadir view of Clouds and the Earth's Radiant Energy System (CERES) instrument's footprints. It also contains vertical profiles of shortwave (SW), longwave (LW), and window (WN) irradiances. The horizontal length of the CERES footprint is approximately 20 km. Files are daily.

Three different cloud and aerosol retrieval results are available. All three retrieval results are either included in one file. Those three retrieval results are:

1) Cloud and aerosol properties derived from MODIS only (similar to the CERES cloud algorithms Ed3). Properties included in this file follow exactly the same format as CERES SSF and CRS. Therefore, cloud properties for up to 2 non-overlapping clouds are retrieved (except for variables from SSF-114a through SSF-114k). The irradiances are computed 5 levels including TOA and the surface.

2) The best estimate of the vertical profile of cloud and aerosol properties derived from CALIPSO, and CloudSat. Note that the retrieval is limited to over the ground track of CALIPSO and CloudSat so that the profiles cover only a small part of a CERES footprint. The vertical resolution of the retrieved cloud and aerosol properties follows the oridinal CALIPSO and CloudSat data source.

   MODIS-derived cloud and aerosol properties retrieved along the ground track of CALIPSO and CloudSat are also included in order to provide the information of the spatial variability of clouds and aerosols over a CERES footprint when these are compared with cloud and aerosol properties from 1).

3) Cloud and aerosol properties derived from enhanced CERES cloud algorithms.
   Cloud and aerosol properties that are derived from MODIS radiances cover either the entire CERES footprint or along the ground track. For this version, the enhanced algorithm is only aplied to over the CALIPSO and CloudSat gound track.

Cloud masking strategy
When either CALIPSO or CloudSat detects a cloud layer:
We keep the cloud layer in the merged file.

When both CALIPSO and CloudSat detect a cloud layer:
Cloud top: Either from CALIPSO or CloudSat whichever reports a higher cloud top
Cloud base: When CALIPSO signal is not attenuated, use the CALIPSO cloud base.
When CALIPSO signal is attenuated, use the CloudSat cloud base.

We keep the precipitation flag from CloudSat. We also keep the lifting condensation level computed from GEOS meteorology.

Table 1: Cloud top and base merging strategy

Cloud boundary	CALIPSO	CloudSat	Merged Cloud boundary
Top	Detected	Detected	Higher cloud top
Top	Detected	Undetected	CALIPSO cloud top
Top	Undetected	Detected	CloudSat cloud top
Base	Not completely attenuated	Undetected	CALIPSO cloud base
Base	Not completely attenuated	Detected	CALIPSO cloud base
Base	Totally attenuated	Detected	CloudSat cloud base
Base	Totally attenuated	Undetected	CALIPSO lowest unattenuated base

Descriptions of CALIPSO and CloudSat cloud and aerosol properties

Cloud and aerosol mask variables

CALIPSO and CloudSat properties are sorted into 1 km horizontal bins (1 km pixels). The resolution of cloud mask is the same as the CALIPSO vertical feature mask resolution, 30 m below 8.2 km and 60 m above 8.2 km. Table 1 describes the merging strategy. Briefly, if CloudSat derived cloud bounday is within 480 m from CALIPSO derived cloud bounday, CALIPSO derived cloud boundary is used. Cloud layers separated by a clear-sky layer of which depth is smaller than the vertical grid size are considered to be a one cloud vertical layer. Clouds in these pixels are further sorted by the vertical profile. Profiles that have the same vertical cloud structure (cloud top and base height, as well as number of overlapping cloud layers) are grouped together. After the grouping process, the cloud fraction of each cloud group along the ground track of CALIPSO and CloduSat is computed.

The file contains up to m = 16 cloud groups (i.e. 16 differnt sets of cloud boundaries) in a CERES footprint. For each combination of cloud overlaps, it allows to have up to p = 6 separate cloud overlapping layers. The cloud group that occurs most often (i.e. the largest number of pixels that have the same cloud overlapping structure, hence the largerst cloud fraction) is reported first in the file.

Example (shown in Figure 1):

Figure 1 shows hypothetical cloud layers over the ground track of CALIPSO and CloudSat in a CERES footprint.

The left most column: Clear fraction of 10%

Second from the left most column: one-layer cloud (cloud fraction = 20%)

Third from the left most column: three-layer clouds (cloud fraction = 20%)

Fourth from the left most column: four layer clouds (cloud fraction = 30%)

The number of cloud groups (cloud overlap combinations) (m) for this case is 3 (i.e. m= 3). The muner of layers p for the first, second and third cloud group is 1, 3, and 4, respectively.

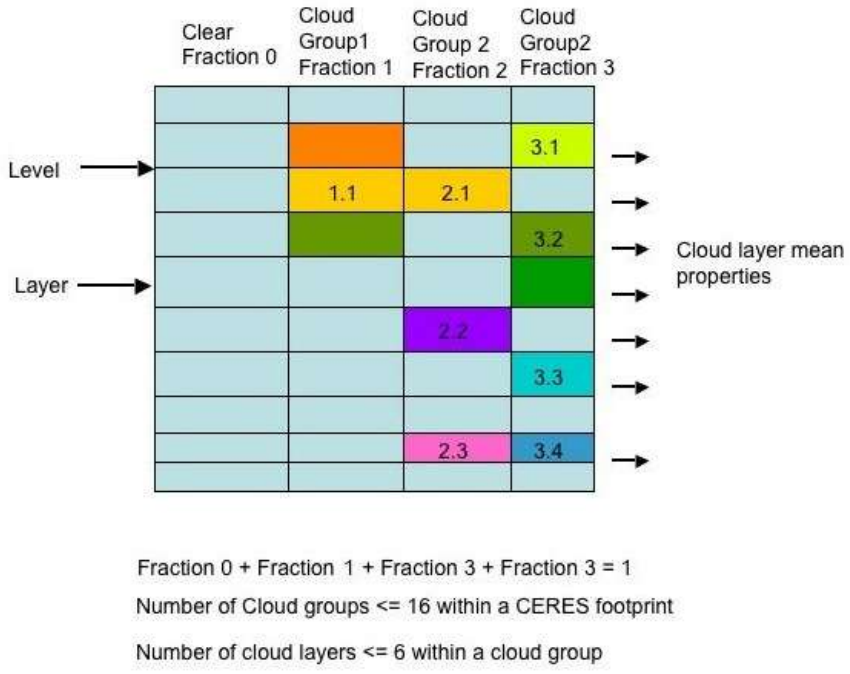


Figure 1. Hypothetical clouds over the CALIPSO and CloudSat ground track in a CERES footprint. Cloud layers in a cloud group are stored from the higher to lower altitudes as shown in this figure.

Cloud layer mean variables
Variables under cloud layer mean contains the values averaged over the CALIPSO and CloudSat ground track within a CERES footprint. The vartial resolution is the same as original CALIPSO and CloudSat products. The layer height of CALIPSO related variables are given by CCCM-124 and CCCM-125. The layer height of CloudSat related variables are given by CCCM-120 and CCCM-121.

Aerosol layer mean variables
Aerosol properties are from Lidar 40 km aerosol profile. Up to 16 layers for a CERES footprint is reported.

Vertical irradiance profile
In addition to top-of-atmosphere (65 km) and surface, the up and downward irradiances are computed at the edge of layers (levels) by the CERES radiative transfer code (FLux model for CERES with K-distribution and correlated-K for Radiation: FLCKKR). Depths of the layers are 120 m below the altitude of 3 km, 240 m from 3 km to 21 km, 480 m from 21 km to 33 km, 3000 m from 33 km to 45 km, 5000m from 45 km to 65 km. The vertical resolution of irradiance profile is given by CCCM-122 and 123.

Level:
Frequency: Daily
Portion of Atmosphere Covered:
Portion of Globe Covered:
File: Near Nadir Satellite Swath
Record: 1 CERES Footprint

Product Version:
Aqua:

SSF Metadata
The following table lists variables in the header in addition to variables that already in CERES SSF file.

The layer center height is the midlevel of each layer.
The layer boundaries are given by the level height.

Table 1.0-1. CCCM_Header

Item	Description	Units	Range	Elements	Bytes/ Elem
CCCM-H1	CCCM_id	N/A	118 or 1118	1	4
CCCM-H2	CERES Instrument name	N/A	ASCII string	1	4
CCCM-H3	Day/time starting hour	N/A	ASCII string	1	28
CCCM-H4	Satellite name	N/A	ASCII string	1	4
CCCM-H5	Imager name	N/A	ASCII string	1	8
CCCM-H6	number of imager channels	N/A	1 .. 20	1	4
CCCM-H7	imager wavelength	μm	0.4 .. 15.0	20	4
CCCM-H8	Earth-sun distance	AU	0.98 .. 1.02	1	4
CCCM-H9	Beta angle	deg	-90 .. 90	1	4
CCCM-H10	Starting subsatellite co-latitude	deg	0 .. 180	1	4
CCCM-H11	Starting subsatellite longitude	deg	0 .. 360	1	4
CCCM-H12	Ending subsatellite co-latitude	deg	0 .. 180	1	4
CCCM-H13	Ending subsatellite longitude	deg	0 .. 360	1	4
CCCM-H14	maximum along-track	deg	0 .. 330	1	4
CCCM-H15	Number of CERES footprints	N/A	0 .. 360000	1	4
CCCM-H16	SS4.1 id string	N/A	ASCII string	1	128
CCCM-H17	SS4.2 id string	N/A	ASCII string	1	128
CCCM-H18	SS4.3 id string	N/A	ASCII string	1	128
CCCM-H19	SS4.4 id string	N/A	ASCII string	1	128
CCCM-H20	SS4.5 id string	N/A	ASCII string	1	128
CCCM-H21	SS4.6 id string	N/A	ASCII string	1	128
CCCM-H22	IES production date	N/A	ASCII string	1	24
CCCM-H23	MOA production date	N/A	ASCII string	1	24
CCCM-H24	SSF production date	N/A	ASCII string	1	24
CCCM-H25	Spare real	N/A	real	1	4

CCCM-H26	satpos_x_beg	km	-360000 .. 360000	1	8
CCCM-H27	satpos_y_beg	km	-360000 .. 360000	1	8
CCCM-H28	satpos_z_beg	km	-360000 .. 360000	1	8
CCCM-H29	nvec_x_beg	km	-360000 .. 360000	1	8
CCCM-H30	nvec_y_beg	km	-360000 .. 360000	1	8
CCCM-H31	nvec_z_beg	km	-360000 .. 360000	1	8
CCCM-H32	InstSARB_ver	N/A	1 .. 32000	1	2
CCCM-H33	CRS production date	N/A	ASCII string	1	19
CCCM-H34	Character Spare	N/A	ASCII string	1	3
CCCM-H35	CCCM production date	N/A	ASCII string	1	24
CCCM-H36	Cloud layer heights	km	-0.5 .. 22.0	1	4
CCCM-H37	Cloud level heights	km	-0.5 .. 22.0	1	4
CCCM-H38	Irradiance layer height	km	-0.5 .. 65.0	1	4
CCCM-H39	Irradiance level height	km	-0.5 .. 65.0	1	4
CCCM-H40	CALIPSO layer height	km	-0.5 .. 22.0	1	4
CCCM-H41	CALIPSO level height	km	-0.5 .. 22.0	1	4
CCCM-H42	SW wavelength bounds	cm^{-1}	1 .. 32000	1	2
CCCM-H43	LW wavelength bounds	cm^{-1}	1 .. 32000	1	2
CCCM-H44	CALIPSO filename and version used 1	N/A	ASCII string	1	128
CCCM-H45	CALIPSO filename and version used 2	N/A	ASCII string	1	128
CCCM-H46	CALIPSO filename and version used 3	N/A	ASCII string	1	128
CCCM-H47	CloudSat filename and version used 1	N/A	ASCII string	1	128
CCCM-H48	CloudSat filename and version used 3	N/A	ASCII string	1	128
CCCM-H49	CloudSat filename and version used 2	N/A	ASCII string	1	128

Variables from CERES SSF

Table 1.0-2. Time and Position

Item	SDS Name (Variable name)	Units	Range	Dimensions	Data type	Maximum daily size (Mb)

SSF-1 (1)	Time of observation	day	2440000 .. 2480000	n	8-bytes real	0.2
SSF-2 (2)	Radius of satellite from center of Earth at observation	km	6000 .. 8000	n	8-bytes real	0.2
SSF-3 (3)	X component of satellite inertial velocity	km sec^{-1}	-10 .. 10	n	8-bytes real	0.2
SSF-4 (4)	Y component of satellite inertial velocity	km sec^{-1}	-10 .. 10	n	8-bytes real	0.2
SSF-5 (5)	Z component of satellite inertial velocity	km sec^{-1}	-10 .. 10	n	8-bytes real	0.2
SSF-6 (6)	Colatitude of subsatellite point at surface at observation	deg	0 .. 180	n	4-bytes real	0.1
SSF-7 (7)	Longitude of subsatellite point at surface at observation	deg	0 .. 360	n	4-bytes real	0.1
SSF-8 (8)	Colatitude of subsolar point at surface at observation	deg	0 .. 180	n	4-bytes real	0.1
SSF-9 (9)	Longitude of subsolar point at surface at observation	deg	0 .. 360	n	4-bytes real	0.1
SSF-10 (10)	Colatitude of CERES FOV at surface	deg	0 .. 180	n	4-bytes real	0.1
SSF-11 (11)	Longitude of CERES FOV at surface	deg	0 .. 360	n	4-bytes real	0.1
SSF-12 (12)	Scan sample number	N/A	1 .. 660	n	2-bytes int	0.05
SSF-13 (13)	Packet number	N/A	0 .. 13100	n	2-bytes int	0.05
SSF-14 (14)	Cone angle of CERES FOV at satellite	deg	0 .. 90	n	4-bytes real	0.1
SSF-15 (15)	Clock angle of CERES FOV at satellite wrt inertial velocity	deg	0 .. 360	n	4-bytes real	0.1
SSF-16 (16)	Rate of change of cone angle	deg sec^{-1}	-300 .. 300	n	4-bytes real	0.1
SSF-17 (17)	Rate of change of clock angle	deg sec^{-1}	-20 .. 20	n	4-bytes real	0.1
SSF-18 (18)	Along-track angle of CERES FOV at surface	deg	-30 .. 330	n	4-bytes real	0.1
SSF-19 (19)	Cross-track angle of CERES FOV at surface	deg	-90 .. 90	n	4-bytes real	0.1

Table 1.0-3. Viewing Angles

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Daily Size (MB)
SSF-20 (20)	CERES viewing zenith at surface	deg	0 .. 90	n	4-bytes real	0.1
SSF-21 (21)	solar zenith at surface	deg	0 .. 180	n	4-bytes real	0.1
SSF-22 (22)	CERES relative azimuth at surface	deg	0 .. 360	n	4-bytes real	0.1
SSF-23 (23)	CERES viewing azimuth at surface wrt North	deg	0 .. 360	n	4-bytes real	0.1

CCCM Scientific Data Sets

Simbols used for express dimensions in the following tables.

n (number of near nadir footprints per day) = 24 hr x 3600 sec/hr / 3.3 sec/scan ~ 26182

m (maximum number of cloud layer groups) = 16

p (maximum number of overlapping cloud layer in a cloud group) = 6

Note: IGBP surface type is from CERES.

Table 1.0-4. CALIPSO and MODIS Surface Map Along Ground track

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum DailySize (MB)
CCCM-1 (292)	Mean altitude of surface above sea level	m	-1000... 10000	n	4-bytes real	0.1
CCCM-2 (293)	Stdev of altitude of surface above sea level	m	-1000... 10000	n	4-bytes real	0.1
CCCM-3 (294)	Surface spectral albedo	N/A	0...100	n x 7	4-bytes real	0.7
CCCM-4 (295)	Mean CloudSat surface reflectivity			n	4-bytes real	0.1
CCCM-5 (296)	Stdev CloudSat surface reflectivity			n	4-bytes real	0.1

Following variables in Table 1.0-5 are extracted from CALIPSO (Level 2 vertical feature mask

data product) and Cloudst (2B-CLDCLASS) products and rearranced or averaged over a CEES footprint.

CCCM-18, -19: If an aerosol layer overlap with clouds, we keep one aerosol layer in a cloud group.

CCCM-23, -24: We keep up to m (=16) aerosol layers over clear-sky (cloud less).

Thick smoke (aerosols) sometimes completely attenuates CALIPSO signal, the mean attenuation level for this case is kept separately from attenuation by clouds. When attenuation by aerosol occur, we assume that this CALIPSO profile is clear (cloud free) unless CloudSat see clouds below the attenuation level. Profiles with aerosol attenuation and no CloudSat clouds below the attenuation level are, therefore, included in clear (cloud free) area percent coverage.

Table 1.0-5. Cloud and aerosol mask (CALIPSO and CloudSat)

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Daily Size (MB)
CCCM-6 (297)	Total number of CloudSat profiles	N/A	0.. 70	n	2-bytes int	0.1
CCCM-7 (298)	Total number of CloudSat clear profiles	N/A	0 .. 70	n	2-bytes int	0.1
CCCM-8 (299)	Total number of good CloudSat profiles	N/A	0 .. 70	n	2-bytes int	0.1
CCCM-9 (300)	Total number of CALIPSO profiles	N/A	0 .. 210	n	2-bytes int	0.1
CCCM-10 (301)	Total number of CALIPSO clear profiles	N/A	0 .. 210	n	2-bytes int	0.1
CCCM-11 (302)	Total number of good CALIPSO profiles	N/A	0 .. 210	n	2-bytes int	0.1
CCCM-12 (303)	Cloud group area percent coverage	%	0 ...100	n x m	4-bytes real	1.5
CCCM-13 (304)	Cloud layer top level height	km	-0.5 .. 30	n x m x p	4-bytes real	7.5
CCCM-14 (305)	Cloud top source flag	N/A	11 .. 24	n x m x p	1-bytes int	1.85
CCCM-15 (306)	Cloud layer base level height	km	-0.5 .. 30	n x m x p	4-bytes real	7.5
CCCM-16 (307)	Cloud base source flag	N/A	11 .. 24	n x m x p	1-bytes int	1.85
CCCM-17 (308)	Precipitation flag CloudSat	N/A	0 ...10	n x m	1-bytes int	0.37

CCCM-18 (309)	CALIPSO aerosol layer (overlapping with cloud) top level height	km	-0.5 .. 20.2	n x m	4-bytes real	1.5
CCCM-19 (310)	CALIPSO aerosol layer (overlapping with clouds) base level height	km	-0.5 .. 20.2	n x m	4-bytes real	1.5
CCCM-20 (311)	Mean CALIPSO signal attenuation top level height (cloudy profile)	km	-0.5 .. 20.2	n x m	4-bytes real	1.5
CCCM-21 (312)	Cloud-free area percent coverage (CALIPSO-CloudSat)	%	0 ...100	n	4-bytes real	0.1
CCCM-22 (313)	CALIPSO aerosol area percent coverage without clouds	%	0 ...100	n	4-bytes real	0.1
CCCM-23 (314)	CALIPSO aerosol layer (over clear area) top level height	km	-0.5 .. 20.2	n x m	4-bytes real	1.5
CCCM-24 (315)	CALIPSO aerosol layer (over clear area) base layer height	km	-0.5 .. 20.2	n x m	4-bytes real	1.5
CCCM-25 (316)	Mean CALIPSO signal attenuation level height (aerosol area)	km	-0.5 .. 20.2	n	4-bytes real	0.1
CCCM-26 (317)	CALIPSO signal attenuation area percent coverage	%	0 ..100	n	4-bytes real	0.1

Table 1.0-6. CERES-derived TOA irradiances

SSF-38 (38)	CERES SW TOA flux - upwards	W m^{-2}	0 .. 1400	n x 2	4-bytes real	0.2
SSF-38a (39)	CERES SW TOA flux - downwards	W m^{-2}	0 .. 1400	n x 2	4-bytes real	0.2
SSF-39 (40)	CERES LW TOA flux - upwards	W m^{-2}	0 .. 1400	n x 2	4-bytes real	0.2
SSF-40 (41)	CERES WN TOA flux - upwards	W m^{-2}	0 .. 1400	n x 2	4-bytes real	0.2

Following variabiles in Table 1.0-7 are derived from MODIS radiances by CERES cloud algorithms.
Note:
Clear-area percentage coverage MODIS (CCCM-27) is the MODIS-derived clear-area over the clear area detected by both CALIPSO and MODIS.
Cloud percentage coverage MODIS (CCCM-28) is the MODIS-derived cloud cover for each cloud group.

Second dimensional index

1. scene I.D. from standard cloud algorithms
2. Scene I.D. from enhanced cloud algorithms

Thied dimension (m = 16)
Cloud group

Table 1.0-7. MODIS Properties over CALIPSO and CloudSat cloud and clear groups

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Daily Size (MB)
CCCM-27 (318)	Clear area percent coverage MODIS	%	0 ...100	n x 2	4-bytes real	0.1
CCCM-28 (319)	Cloud percent coverage over group from MODIS	%	0 ...100	n x 2 x m	4-bytes real	1.5
CCCM-29 (320)	Mean group visible optical depth from MODIS radiance	N/A	0 .. 400	n x 2 x m	4-bytes real	1.5
CCCM-30 (321)	Mean group logarithm of visible optical depth from MODIS radiance	N/A	-6 .. 6	n x 2 x m	4-bytes real	1.5
CCCM-31 (232)	Mean group cloud top height from MODIS radiance	km	0 .. 20	n x 2 x m	4-bytes real	
CCCM-32 (323)	Mean group water particle radius from MODIS radiance (3.7)	μm	0 .. 40	n x 2 x m	4-bytes real	1.5
CCCM-33 (324)	Mean group ice particle effective diameter from MODIS radiance (3.7)	μm	0 .. 300	n x 2 x m	4-bytes real	1.5
CCCM-34 (325)	Mean group cloud particle phase from MODIS radiance (3.7)	N/A	1 .. 2	n x 2 x m	4-bytes real	1.5
CCCM-35 (326)	Mean group water particle radius from MODIS radiance (2.1)	μm	0 .. 40	n x 2 x m	4-bytes real	1.5
CCCM-36 (327)	Mean group ice particle effective diameter from MODIS radiance (2.1)	μm	0 .. 300	n x 2 x m	4-bytes real	1.5

Following variables in Table 1.0-8 are from Lidar 5 km aerosol layer product
Backscatter and extinction coefficient are averaged over parts where aerosols are present

Table 1.0-8. CALIPSO aerosol layer mean

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Daily Size (MB)
CCCM-37 (328)	CALIPSO aerosol layer percent coverage	N/A	0 ... 100	n x 16	2-bytes int	0.4
CCCM-38 (329)	CALIPSO aerosol layer top level height	km	-0.5 ... 30.1	n x 16	4-bytes real	0.8
CCCM-39 (330)	CALIPSO aerosol layer base level height	km	-0.5 ... 30.1	n x 16	4-bytes real	0.8
CCCM-40 (331)	CALIPSO aerosol layer opacity flag	N/A	0 ... 1	n x 16	1-bytes int	0.8
CCCM-41 (332)	CALIPSO layer aerosol horizontal avaraging distance	km	5 ... 80	n x 16	1-bytes int	0.4
CCCM-42 (333)	CALIPSO aerosol feature classification flags	N/A	0 … 127 (98298)	n x 16	1-bytes int	0.4
CCCM-43 (334)	Mean CALIPSO aerosol feature optical depth at 532 nm	N/A	0 ... 5.0	n x 16	4-bytes real	0.8
CCCM-44 (335)	Mean CALIPSO feature optical depth uncertainty at 532 nm	N/A	0 … TBD	n x 16	4-bytes real	0.8
CCCM-45 (336)	Mean CALIPSO feature optical depth at 1064 nm	N/A	0 ... 5.0	n x 16	4-bytes real	0.8
CCCM-46 (337)	Mean CALIPSO feature optical depth uncertainty at 1064 nm	N/A	0 ... TBD	n x 16	4-bytes real	0.8
CCCM-47 (338)	Mean CALIPSO relative humidity in aerosol layer	%	0 ... 100	n x 16	4-bytes real	0.8
CCCM-48 (339)	Mean CALIPSO aerosol layer CAD score	N/A	-100 ... 100	n x 16	2-bytes int	0.4
CCCM-49 (340)	Mean CALIPSO aerosol optical thickness over cloud free area	N/A	0 ... 5.0	n	4-bytes real	0.1
CCCM-50 (341)	Stdev CALIPSO aerosol optical thickness over cloud free area	N/A	0 ... 5.0	n	4-bytes real	0.1

Following variables in Table 1.0-9 are from lidar level 2 cloud 5 km layer product, level 2 5 km cloud profile data product, and CloudSat 2B-CLDCLASS and 2B-CWC-RO products. CALIPSO data are stored with 345 vertical resolutions. The height informatin is given by CCCM-H4. Other variables are stored with 113 vetical resolution. The height informatin is given by CCCM-H1.

The second dimension of CCCM-73 is from 2B-CLDCLASS. 1:High clouds, 2:As, 3: Ac, 4:St, 5:Sc, 6:Cu, 7:Ns, 8: Deep conventive clouds.

Table 1.0-9. Cloud layer mean

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Daily Size (MB)
CCCM-51 (342)	CALIPSO layer cloud type profile	N/A	0...7	n x 113	2-bytes int	11.3
CCCM-52 (343)	Cloud fraction profile	N/A	0...100	n x 113	4-bytes real	11.3
CCCM-53 (344)	Mean CALIPSO cloud layer CAD score	N/A	-100 ... 102	n x 345	2-bytes int	0.1
CCCM-54 (345)	Mean CALIPSO cloud layer extinction coefficient at 532 nm	km^{-1}	0...100	n x 345	4-bytes real	34.5
CCCM-55 (346)	Mean CALIPSO constrained cloud layer extinction coefficient at 532 nm	km^{-1}	0...100	n x 345	4-bytes real	34.5
CCCM-56 (347)	Mean logarithm of CALIPSO extinction coefficient at 532 nm	N/A	-6.0 … 6.0	n x 345	4-bytes real	34.5
CCCM-57 (348)	CALIPSO extinction coefficient uncertainty at 532 nm	km^{-1}	0 … TBD	n x 345	4-bytes real	34.5
CCCM-58 (349)	Mean CALIPSO ice water content	gm^{-3}	0 … TBD	n x 345	4-bytes real	34.5
CCCM-59 (350)	Stdev of CALIPSO ice water content	gm^{-3}	0 … TBD	n x 345	4-bytes real	34.5
CCCM-60 (351)	CALIPSO ice water content uncertainty	gm^{-3}	0 … TBD	n x 345	4-bytes real	34.5
CCCM-61 (352)	Mean CloudSat radar only liquid effective radius	μm	0 … 1000	n x 113	4-bytes real	11.3
CCCM-62 (353)	Stdev of CloudSat radar only liquid effective radius	μm	0 … 1000	n x 113	4-bytes real	11.3
CCCM-63 (354)	CloudSat radar only liquid effective radius uncertainty	N/A	0 … 250	n x 113	4-bytes real	11.3
CCCM-64 (355)	Mean CloudSat radar only ice effective radius	μm	0 … 3000	n x 113	4-bytes real	11.3
CCCM-65 (356)	Stdev of CloudSat radar only ice effective radius	μm	0 … 3000	n x 113	4-bytes real	11.3
CCCM-66 (357)	CloudSat radar only ice effective radius uncertainty	N/A	0 … 250	n x 113	4-bytes real	11.3
CCCM-67 (358)	Mean CloudSat radar only liquid water content	gm^{-3}	0 ... 15.0	n x 113	4-bytes real	11.3

Table 1.0-9. Cloud layer mean

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Daily Size (MB)
CCCM-68 (359)	Stdev of CloudSat radar only liquid water content	gm^{-3}	0 ... 15.0	n x 113	4-bytes real	11.3
CCCM-69 (360)	CloudSat radar only liquid water content uncertainty	N/A	0 … 250	n x 113	4-bytes real	11.3
CCCM-70 (361)	Mean CloudSat radar only ice water content	gm^{-3}	0 ... 10.0	n x 113	4-bytes real	11.3
CCCM-71 (362)	Stdev of CloudSat radar only ice water content	gm^{-3}	0 ... 10.0	n x 113	4-bytes real	11.3
CCCM-72 (363)	CloudSat radar only ice water content uncertainty	N/A	0 … 250	n x 113	4-bytes real	11.3
CCCM-73 (364)	CloudSat cloud type histogram	100 * %	0 ... 10000	n x 8	2-bytes int	0.8

Irradiance profile variables (Table 1.0-10 and 1.0-11).
All fluxes are given at the edge of each layers (138 levels, 1 = TOA, 138 = sea level -480 m, CCCM-H4).

The second dimensional index of irradiance profiles is

1 = cloud+aerosol (all-sky)
2 = cloud only (all-sky with no aerosols)
3 = clear-sky (with aerosol)
4 = clear-sky (without aerosol, pristine).

The third demensional index is the vertical level.

Wavelength information of TOA and surface spectral irradiances is given by CCCM-H7 (shortwave) and CCCM-H8 (longwave).

Note for Window flux: Modeled window irradiances have different spectral band than the CERES window channel. The equivalent window irradiance is kept only for TOA (CCCM-93). The CERES window flux is computed with CALIPSO-CloudSat clouds and clouds from MODIS enhanced algorithm.

Note for irradiance model flag: The flag indicates where the optical property of clouds and aerosols come from.

Table 1.0-10. Vertical model input profile

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Daily Size (MB)
CCCM-74 (365)	Modeled aerosol type	N/A	0 … 100	n x 7	2-bytes int	0.35
CCCM-75 (366)	Aerosol source flag	N/A	0 …. 10	n	2-bytes int	0.05
CCCM-75 (367)	Surface albedo source	N/A	0 …. 10	n	2-bytes int	0.05
CCCM-76 (368)	Pressure profile	hPa	0 ... 1100	n x 138	4-bytes real	13.2
CCCM-77 (369)	Temperature profile	K	100 ... 400	n x 138	4-bytes real	13.2
CCCM-78 (370)	Water vapor mixing ratio profile	g/g	0.00001 …. 0.03	n x 138	4-bytes real	6.6
CCCM-79 (371)	Ozone mixing ratio profile	g/g	0.0 … 0.00005	n x 138	4-bytes real	6.6
CCCM-80 (372)	Surface geopotential height	m	-100 ... 10000	n	2-bytes int	0.05
CCCM-81 (373)	Lifting condensation level	hPa	0...1100	n	2-bytes int	0.05
CCCM-82 (374)	Aerosol extinction coefficient profile used	km^{-1}	0 … 10.0	n x 137	4-bytes real	13.2
CCCM-83 (375)	Aerosol single scattering albedo profile used	N/A	0 … 1.0	n x 137	4-bytes real	13.2
CCCM-84 (376)	Cloud extinction coefficient profile used	km^{-1}	0...128	n x 137	4-bytes real	13.2
CCCM-85 (377)	Liquid water content profile used	gm^{-3}	0 ... 15.0	n x 137	4-bytes real	13.2
CCCM-86 (378)	Ice water content profile used	gm^{-3}	0 ... 10.0	n x 137	4-bytes real	13.2

Table 1.0-11. Vertical Irradiance profile

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Daily Size (MB)
CCCM-87 (379)	SW downward flux profile untuned (CALIPSO CloudSat)	Wm^{-2}	0 ... 1500	n x 4 x 138	4-bytes real	52.8

Table 1.0-11. Vertical Irradiance profile

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Daily Size (MB)
CCCM-88 (380)	SW upward flux profile untuned (CALIPSO CloudSat)	Wm^{-2}	0 ... 1500	n x 4 x 138	4-bytes real	52.8
CCCM-89 (381)	LW downward flux profile untuned (CALIPSO CloudSat)	Wm^{-2}	0 ... 1500	n x 4 x 138	4-bytes real	52.8
CCCM-90 (382)	LW upward flux profile untuned (CALIPSO CloudSat)	Wm^{-2}	0 ... 1500	n x 4 x 138	4-bytes real	52.8
CCCM-91 (383)	WN downward flux profile untuned (CALIPSO CloudSat)	Wm^{-2}	0 ... 1500	n x 4 x 138	4-bytes real	52.8
CCCM-92 (384)	WN upward flux profile untuned (CALIPSO CloudSat)	Wm^{-2}	0 ... 1500	n x 4 x 138	4-bytes real	52.8
CCCM-93 (385)	SW downward flux TOA untuned (MODIS enhanced)	Wm^{-2}	0 ... 1500	n x 4	4-bytes real	0.8
CCCM-94 (386)	SW upward flux TOA untuned (MODIS enhanced)	Wm^{-2}	0 ... 1500	n x 4	4-bytes real	0.8
CCCM-95 (387)	SW downward flux surface untuned (MODIS enhanced)	Wm^{-2}	0 ... 1500	n x 4	4-bytes real	0.8
CCCM-96 (388)	SW upward flux surface untuned (MODIS enhanced)	Wm^{-2}	0 ... 1500	n x 4	4-bytes real	0.8
CCCM-97 (389)	LW downward flux surface untuned (MODIS enhanced)	Wm^{-2}	0 ... 1500	n x 4	4-bytes real	0.8
CCCM-98 (390)	LW upward flux TOA untuned (MODIS enhanced)	Wm^{-2}	0 ... 1500	n x 4	4-bytes real	0.8
CCCM-99 (391)	LW upward flux surface untuned (MODIS enhanced)	Wm^{-2}	0 ... 1500	n x 4	4-bytes real	0.8
CCCM-100 (392)	WN downward flux surface untuned (MODIS enhanced)	Wm^{-2}	0 ... 1500	n x 4	4-bytes real	0.8
CCCM-101 (393)	WN upward flux TOA untuned (MODIS enhanced)	Wm^{-2}	0 ... 1500	n x 4	4-bytes real	0.8
CCCM-102 (394)	WN upward flux surface untuned (MODIS enhanced)	Wm^{-2}	0 ... 1500	n x 4	4-bytes real	0.8
CCCM-103 (395)	SW all-sky upward TOA spectral flux untuned	Wm^{-2}	0 ... 1500	n x 14	4-bytes real	1.4
CCCM-104 (396)	SW all-sky downward TOA spectral flux untuned	Wm^{-2}	0 ... 1500	n x 14	4-bytes real	1.4
CCCM-105 (397)	SW all-sky upward surface spectral flux untuned	Wm^{-2}	0 ... 1500	n x 14	4-bytes real	1.4
CCCM-106 (398)	SW all-sky downward surface spectral flux untuned	Wm^{-2}	0 ... 1500	n x 14	4-bytes real	1.4

Table 1.0-11. Vertical Irradiance profile

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Daily Size (MB)
CCCM-107 (399)	LW all-sky upward TOA spectral flux untuned	$Wm^{-2} sr^{-1}$	0 ... 1500	n x 12	4-bytes real	1.2
CCCM-108 (400)	LW all-sky upward surface spectral flux untuned	Wm^{-2}	0 ... 1500	n x 12	4-bytes real	1.2
CCCM-109 (401)	LW all-sky downward surface spectral flux untuned	K	0 ... 1500	n x 12	4-bytes real	1.2
CCCM-110 (402)	LW TOA modeled unfiltered radiance untuned (CALIPSO-CloudSat)	$Wm^{-2} sr^{-1}$	0 … 200	n	4-bytes real	0.2
CCCM-111 (403)	WN TOA modeled unfiltered radiance untuned (CALIPSO-CloudSat)	$Wm^{-2} sr^{-1}$	0 … 60	n	4-bytes real	0.2
CCCM-112 (404)	WN TOA modeled filtered radiance untuned (CALIPSO-CloudSat)	Wm^{-2} sr-1	0 … 50	n	4-bytes real	0.2
CCCM-113 (405)	WN TOA upward flux untuned (CALIPSO CloudSat,)	Wm^{-2}	0 ... 1500	n	4-bytes real	0.2
CCCM-114 (406)	LW TOA modeled unfiltered radiance enhanced (CALIPSO-CloudSat)	$Wm^{-2} sr^{-1}$	0 … 200	n	4-bytes real	0.2
CCCM-115 (407)	WN TOA modeled unfiltered radiance enhanced (CALIPSO-CloudSat)	$Wm^{-2} sr^{-1}$	0 … 60	n	4-bytes real	0.2
CCCM-116 (408)	WN TOA modeled filtered radiance enhanced (CALIPSO-CloudSat)	Wm^{-2} sr-1	0 … 50	n	4-bytes real	0.2
CCCM-117 (409)	WN TOA upward flux enhanced (CALIPSO CloudSat,)	Wm^{-2}	0 ... 1500	n	4-bytes real	0.2
CCCM-118 (410)	Irradiance modeling source flag	N/A	0 … 6000	n	2-bytes int	6.6
CCCM-119 (411)	Flux confidence flag	N/A	0 … 32767	n x 2	2-bytes int	

Coordinate variables

CCCM-120 (412)	Irradiance surface level	N/A		n	2-bytes int
CCCM-121 (413)	Layer center height (clouds and aerosols)	km	-0.42...29.75	113	4-bytes real
CCCM-122 (414)	Level height (clouds and aerosols)	km	-0.48...30	114	4-bytes real

CCCM-123 (415)	Layer center height (irradiances)	km	-0.42...62.5	137	4-bytes real
CCCM-124 (416)	Level height (irradiances)	km	-0.48...65	138	4-bytes real
CCCM-125 (417)	CALIPSO layer center height (layer mean)	km	-0.47....20.17	345	4-bytes real
CCCM-126 (418)	CALIPSO level height (layer mean)	km	-0.50....20.20	346	4-bytes real
CCCM-127 (419)	Shortwave computational spectral bands	cm^{-1}	1 .. 32000	15	2-bytes int
CCCM-128 (420)	Longwavewave computational spectral bands	cm^{-1}	1 .. 32000	13	2-bytes int

SSF Parameters

When the second dimensional index is 2, it reffers to cloud 1 and cloud 2, where cloud 1 is lower altitude than cloud 2.

Second (or third) dimensional index

1. Cloud and aerosol properties derived from MODIS radiances by standard CERES cloud algorithms and averaged over the entire CERES footprint
2. Cloud and aerosol properties derived from MODIS radiances by standard CERES cloud algorithms and averaged only along the ground track
3. Cloud and aerosol properties derived from MODIS radiances by enhanced CERES cloud algorithms and averaged only along the ground track
4. Cloud and aerosol properties derived from MODIS radiances by enhanced CERES cloud algorithms and averaged over the entire CERES footprint

Table 1.0-12. Properties derived from MODIS from clear-sky area

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-66 (77)	Clear area percent coverage at subpixel resolution	N/A	0 .. 100	n x 4	4-bytes real	0.4
SSF-67 (78)	Cloud-mask clear-strong percent coverage	N/A	0 .. 100	n x 4	2-bytes int	0.2
SSF-68 (79)	Cloud-mask clear-weak percent coverage	N/A	0 .. 100	n x 4	2-bytes int	0.2
SSF-69 (80)	Cloud-mask snow/ice percent coverage	N/A	0 .. 100	n x 4	2-bytes int	0.2

SSF-70 (81)	Cloud-mask aerosol B percent coverage	N/A	0 .. 100	n x 4	2-bytes int	0.2
SSF-71 (82)	Flag - Type of aerosol B	N/A	0 .. 9999	n x 4	2-bytes int	0.2
SSF-72 (83)	Cloud-mask percent coverage supplement	N/A	0 .. 32766	n x 4	2-bytes int	0.2
SSF-73 (84)	Total aerosol A optical depth - visible	N/A	-1 .. 5	n x 4	4-bytes real	0.4
SSF-74 (85)	Total aerosol A optical depth - near IR	N/A	-1 .. 5	n x 4	4-bytes real	0.4
SSF-75 (86)	Aerosol A supplement 1	N/A	-1000 .. 1000	n x 4	4-bytes real	0.4
SSF-76 (87)	Aerosol A supplement 2	N/A	-1000 .. 1000	n x 4	4-bytes real	0.4
SSF-77 (88)	Aerosol A supplement 3	N/A	-1000 .. 1000	n x 4	4-bytes real	0.4
SSF-78 (89)	Aerosol A supplement 4	N/A	-1000 .. 1000	n x 4	4-bytes real	0.4
SSF-79 (90)	CWG surface skin temperature	K	175 .. 375	n x 4	4-bytes real	0.4
SSF-79a (91)	CWG precipitable water	cm	0.001 .. 10	n x 4	4-bytes real	0.4
SSF-80 (92)	Vertical temperature change	K	-30 .. 90	n x 4	4-bytes real	0.4

Table 1.0-13. Properties derived from MODIS from cloudy-sky area

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-81 (93)	Clear/layer/overlap percent coverages	N/A	0 .. 100	n x 4 x 4	4-bytes real	1.6
SSF-82 (94)	Note for cloud layer	N/A	0 .. (2^{31-1})	n x 4 x 2	4-bytes int	0.8
SSF-83 (95)	Mean visible optical depth for cloud layer	N/A	0 .. 400	n x 4 x 2	4-bytes real	0.8
SSF-84 (96)	Stddev of visible optical depth for cloud layer	N/A	0 .. 300	n x 4 x 2	4-bytes real	0.8
SSF-85 (97)	Mean logarithm of visible optical depth for cloud layer	N/A	-6 .. 6	n x 4 x 2	4-bytes real	0.8
SSF-86 (98)	Stddev of logarithm of visible optical depth for cloud layer	N/A	0 .. 6	n x 4 x 2	4-bytes real	0.8

Table 1.0-13. Properties derived from MODIS from cloudy-sky area

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-87 (99)	Mean cloud infrared emissivity for cloud layer	N/A	0 .. 2	n x 4 x 2	4-bytes real	0.8
SSF-88 (100)	Stddev of cloud infrared emissivity for cloud layer	N/A	0 .. 2	n x 4 x 2	4-bytes real	0.8
SSF-89 (101)	Mean liquid water path for cloud layer (3.7)	g m^{-2}	0 .. 10000	n x 4 x 2	4-bytes real	0.8
SSF-90 (102)	Stddev of liquid water path for cloud layer (3.7)	g m^{-2}	0 .. 8000	n x 4 x 2	4-bytes real	0.8
SSF-91 (103)	Mean ice water path for cloud layer (3.7)	g m^{-2}	0 .. 10000	n x 4 x 2	4-bytes real	0.8
SSF-92 (104)	Stddev of ice water path for cloud layer (3.7)	g m^{-2}	0 .. 8000	n x 4 x 2	4-bytes real	0.8
SSF-93 (105)	Mean cloud top pressure for cloud layer	hPa	0 .. 1100	n x 4 x 2	4-bytes real	0.8
SSF-94 (106)	Stddev of cloud top pressure for cloud layer	hPa	0 .. 600	n x 4 x 2	4-bytes real	0.8
SSF-94a (107)	Mean cloud top temperature for cloud layer	K	100 .. 350	n x 4 x 2	4-bytes real	0.8
SSF-94b (108)	Mean cloud top height for cloud layer	km	0 .. 20	n x 4 x 2	4-bytes real	0.8
SSF-95 (109)	Mean cloud effective pressure for cloud layer	hPa	0 .. 1100	n x 4 x 2	4-bytes real	0.8
SSF-96 (110)	Stddev of cloud effective pressure for cloud layer	hPa	0 .. 500	n x 4 x 2	4-bytes real	0.8
SSF-97 (111)	Mean cloud effective temperature for cloud layer	K	100 .. 350	n x 4 x 2	4-bytes real	0.8
SSF-98 (112)	Stddev of cloud effective temperature for cloud layer	K	0 .. 150	n x 4 x 2	4-bytes real	0.8
SSF-99 (113)	Mean cloud effective height for cloud layer	km	0 .. 20	n x 4 x 2	4-bytes real	0.8
SSF-100 (114)	Stddev of cloud effective height for cloud layer	km	0 .. 12	n x 4 x 2	4-bytes real	0.8
SSF-101 (115)	Mean cloud base pressure for cloud layer	hPa	0 .. 1100	n x 4 x 2	4-bytes real	0.8
SSF-102 (116)	Stddev of cloud base pressure for cloud layer	hPa	0 .. 600	n x 4 x 2	4-bytes real	0.8
SSF-102a (117)	Mean cloud base temperature for cloud layer	K	100 .. 350	n x 4 x 2	4-bytes real	0.8

Table 1.0-13. Properties derived from MODIS from cloudy-sky area

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-103 (118)	Mean water particle radius for cloud layer (3.7)	μm	0 .. 40	n x 4 x 2	4-bytes real	0.8
SSF-104 (119)	Stddev of water particle radius for cloud layer (3.7)	μm	0 .. 20	n x 4 x 2	4-bytes real	0.8
SSF-105 (120)	Mean ice particle effective diameter for cloud layer (3.7)	μm	0 .. 300	n x 4 x 2	4-bytes real	0.8
SSF-106 (121)	Stddev of ice particle effective diameter for cloud layer (3.7)	μm	0 .. 200	n x 4 x 2	4-bytes real	0.8
SSF-107 (122)	Mean cloud particle phase for cloud layer (3.7)	N/A	1 .. 2	n x 4 x 2	4-bytes real	0.8
SSF-110a (123)	Mean water particle radius for cloud layer (2.1)	μm	0 .. 40	n x 4 x 2	4-bytes real	0.8
SSF-110b (124)	Mean ice particle effective diameter for cloud layer (2.1)	μm	0 .. 300	n x 4 x 2	4-bytes real	0.8
SSF-110c (125)	Mean logarithm of visible optical depth for cloud layer (2.1)	N/A	-6 .. 6	n x 4 x 2	4-bytes real	0.8
SSF-110a (126)	Mean water particle radius for cloud layer (1.6)	μm	0 .. 40	n x 2 x 4	4-bytes real	0.8
SSF-110b (127)	Mean ice particle effective diameter for cloud layer (1.6)	μm	0 .. 300	n x 2 x 4	4-bytes real	0.8
SSF-110c (128)	Mean logarithm of visible optical depth for cloud layer (1.6)	N/A	-6 .. 6	n x 2 x 4	4-bytes real	0.8
SSF-111 (129)	CO2 slicing percent coverages for cloud layer	N/A	0 .. 100	n x 4 x 2	4-bytes real	0.8
SSF-111a (130)	Mean infrared emissivity for cloud layer - CO2 slicing	N/A	0 .. 2	n x 4 x 2	4-bytes real	0.8
SSF-111b (131)	Mean effective pressure for cloud layer - CO2 slicing	hPa	0 .. 1100	n x 4 x 2	4-bytes real	0.8
SSF-111c (132)	Mean effective temperature for cloud layer - CO2 slicing	K	100 .. 350	n x 4 x 2	4-bytes real	0.8
SSF-112 (133)	Mean effective height for cloud layer - CO2 slicing	km	0 .. 20	n x 4 x 2	4-bytes real	0.8
SSF-113 (134)	Percentiles of visible optical depth for cloud layer	N/A	0 .. 400	n x 4 x 13 x 2	4-bytes real	10.4

The second dimensional index is the same as the third index of variables in Table 1.0-12. The third dimensional dimensional index of variables in Table 1.0-14.

1. single lower cloud layer from Ed2 cloud algorithm that are not multi-layer including optically thick clouds
2. single upper cloud layer from Ed2 cloud algorithm that are not multilayer including optically thick clouds
3. multilayer cloud that were assigned to lower cloud layer when the Ed2 cloud algorithm is used.
4. multilayer cloud that were assigned to upper cloud layer when the Ed2 cloud algorithm is used

Descriptions of how these 4 cloud classifications are made and other cloud properties associated with these cloud classes are included below because these are significantly different from Ed2.

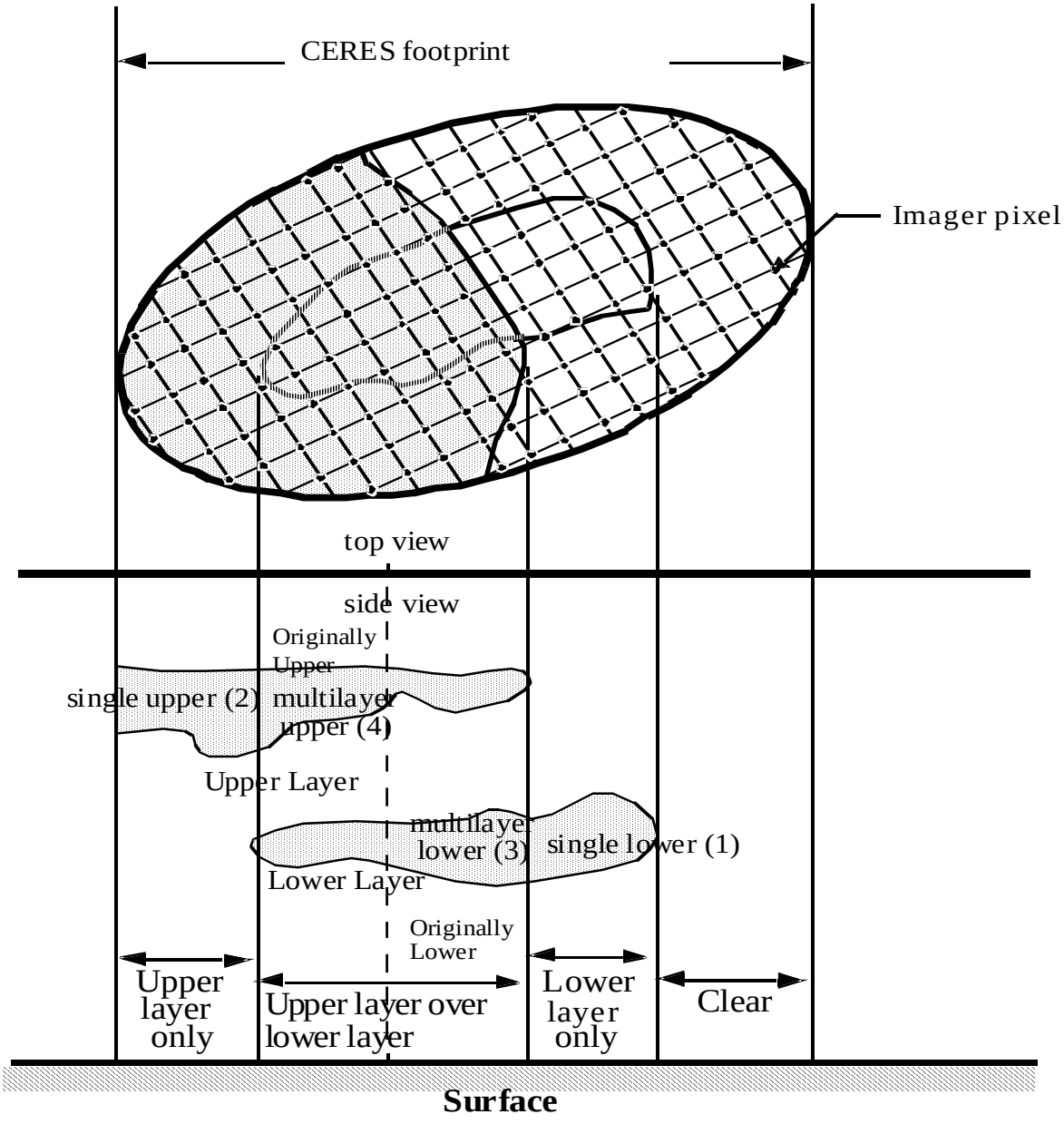


Figure 2. CERES Single layer/multilayer illustration. The cloud classification of (1), (2), (3), and (4) in Ed3 SSF. Note that if the Ed2 cloud algorithm is used, (1) and (3) are classified as a lower layer and (2) and (4) are classified as an upper layer because cloud overlap is not treated in the algorithm. **The total multilayer coverage is obtained by adding the multilayer lower (3) to the multilayer upper cloud (4). Total lower cloud layer coverage is obtained by adding the single layer lower cloud (1) percent coverage to the multilayer lower (3) and multilayer upper (4) cloud percent coverage. Likewise, total upper cloud layer coverage is obtained by adding the singlelayer upper cloud (2) percent coverage to the multilayer lower (3) and multilayer upper cloud (4) percent coverage.** The cloud layer parameters that follow (See SSF-114b thru SSF-114k SSF-82 thru SSF-114) are based on cloud cover for just that area. Single lower layer (1) corresponds to the layer lowest in height from SSF-81 that was determined not to be multilayer and single upper layer (2), if it exists, is above layer 1 and was determined not to be multilayer. The multilayer lower level (3) is the layer lowest in height from imager pixels that were determined to be multilayer regardless of whether the pixels were assign to the lower or higher layer in SSF-81. The multilayer upper level (4) is the layer highest in height from imager pixels that were determined to be multilayer regardless of whether the pixels were assign to the lower or higher layer in SSF-81. The cloud properties for multilayer has the total multilayer coverage. It is possible to have multilayer level properties when one of the multilayer coverages is 0. When a single layer percent coverage is 0 or single layer/multilayer coverage is CERES default , all the variables associated with that layer will be filled in with the CERES default.

If none of the 4 coverages for a given FOV are set to CERES default, their sum is 100 minus clear coverage (SSF-81) plus minus a round off error. When there is only one cloud layer from SSF-81, its weighted area percentage is always recorded as the lower cloud coverage. Any of the conditions which are known not to exist within the CERES FOV have a weighted area percentage of 0. For example, if there is only one cloud layer, the single layer upper cloud percent coverage and the multi-layer upper percent coverage are set to 0. Similarly, if there are no clouds, all percent coverages are set to 0.

When single layer/multi-layer percent coverage are not known, they are set to CERES default. For example, single layer/multi-layer percent coverage are set to CERES default when the "Cloud property extrapolation over cloudy area" (See SSF-63) is set to CERES default. Single layer/multi-layer percent coverages are all set to CERES default when "Number of imager pixels in CERES FOV" (See SSF-53) is set to 0.

SSF-114b Mean visible optical depth for mulitlayer

This parameter is a PSF-weighted mean of the visible optical depth values associated with imager pixels which fall within the current CERES FOV and have a cloud at the corresponding single layer/multilayer portion. (N/A) [0 .. 400] .
The bin-averaged values are weighted by the imager pixel fraction of corresponding layer imager pixels to total imager pixels and PSF. If there are no imager pixels with valid optical depth values or if the corresponding single layer area percent coverage or both multilayer area percent coverage is set to 0 or CERES default, this variable is set to CERES default. At night the mean

visible optical depth for cloud layer is always set to CERES default.

SSF-114e Mean cloud top pressure for multilayer

This parameter is a PSF-weighted mean of the top pressure values associated with imager pixels which fall within the current CERES FOV and have a cloud at the corresponding single layer/multilayer portion. (hPa) [0 .. 1100].

The bin-averaged values are weighted by the imager pixel fraction of corresponding layer imager pixels to total imager pixels and PSF. If there are no imager pixels with valid cloud top pressure values or if the corresponding single layer or both multilayer area percent coverage is set to 0 or CERES default, this variable is set to CERES default. If tow cloud layers exist within a CERES footprint according to the Ed2 cloud algorithm, such as shown in Figure 2, 4 cloud top pressures corresponds to 4 cloud percent coverage in SSF-114a. However, if only one layer exists within a footprint, clod top pressure is stored in the way shown in Figure 3.

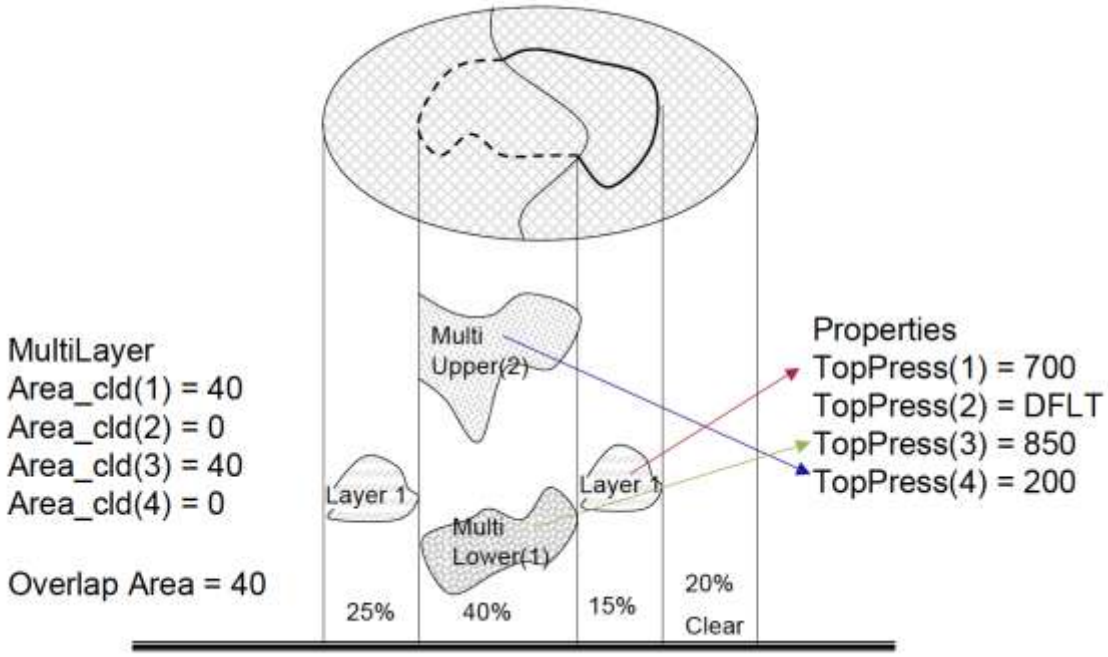


Figure 3, The place where the cloud top pressure stored in SSF-114e when the Ed2 cloud algorithm prodices a 1 layer cloud but Ed3 algorithm detects multiple layers in a footprint.

Based on the phase, effective cloud temperature, and the cloud emissivity, cloud retrieval uses a set of empirical formulae to compute the emissivity relative to the physical top of the cloud rather than to the effective height of the cloud. This cloud-top emissivity is used to compute an estimate of cloud-top radiance using the clear-sky and observed radiances. Cloud-top radiance is converted to cloud-top temperature using the inverse Planck function. The temperature and height profiles from reanalysis (MOA) are linearly interpolated, and the height value that

corresponds to the cloud-top temperature is selected. The tops of clouds with large emissivities (> 0.99) are assumed to be the same as the cloud effective height. The cloud-top pressure is obtained from the cloud height using the interpolated MOA profiles. Cloud top pressure is not calculated at night.

SSF-114f Mean cloud top temperature for multilayer

This parameter is a PSF-weighted mean of the top temperature values associated with imager pixels which fall within the current CERES FOV and have a cloud at the corresponding single layer/multilayer. (K) [100 .. 350].

The bin-averaged values are weighted by the imager pixel fraction of corresponding layer imager pixels to total imager pixels and PSF. If there are no imager pixels with valid cloud top temperature values or if the corresponding single layer or both multilayer area percent coverage is set to 0 or CERES default, this variable is set to CERES default.
Based on the phase, effective cloud temperature, and the cloud emissivity, cloud retrieval uses a set of empirical formulae to compute the emissivity relative to the physical top of the cloud rather than to the effective height of the cloud. This cloud-top emissivity is used to compute an estimate of cloud-top radiance using the clear-sky and observed radiances. Cloud-top radiance is converted to cloud-top temperature using the inverse Planck function. The tops of clouds with large emissivities (> 0.99) are assumed to be the same as the cloud effective height. Cloud top temperature is not calculated at night.

SSF-114g Mean cloud top height for multilayer

This parameter is a PSF-weighted mean of the top height values associated with imager pixels which fall within the current CERES FOV and have a cloud at the corresponding single layer/multilayer portion. (km) [0 .. 20].

The bin-averaged values are weighted by the imager pixel fraction of corresponding layer imager pixels to total imager pixels and PSF. If there are no imager pixels with valid cloud top pressure values or if the corresponding single layer or both multilayer area percent coverage is set to 0 or CERES default, this variable is set to CERES default.

Based on the phase, effective cloud temperature, and the cloud emissivity, cloud retrieval uses a set of empirical formulae to compute the emissivity relative to the physical top of the cloud rather than to the effective height of the cloud. This cloud-top emissivity is used to compute an estimate of cloud-top radiance using the clear-sky and observed radiances. Cloud-top radiance is converted to cloud-top temperature using the inverse Planck function. The temperature and height profiles from realaysis (MOA) are linearly interpolated, and the height value that corresponds to the cloud-top temperature is selected. The tops of clouds with large emissivities (> 0.99) are assumed to be the same as the cloud effective height. Cloud top height is not calculated at night.

SSF-114h Mean cloud top pressure for multilayer

This parameter is a PSF-weighted mean of the top height values associated with imager pixels which fall within the current CERES FOV and have a cloud at the corresponding single

layer/multilayer portion. (km) [0 .. 1100].

SSF-114i Mean cloud effective temperature for multilayer

This parameter is a PSF-weighted mean of the effective temperature values associated with imager pixels which fall within the current CERES FOV and have a cloud at the corresponding single layer/multilayer portion. (K) [100 .. 350] .
The bin-averaged values are weighted by the imager pixel fraction of corresponding layer imager pixels to total imager pixels and PSF. If there are no imager pixels with valid cloud effective temperature values or if the corresponding single layer or both multilayer area percent coverage is set to 0 or CERES default, this variable is set to CERES default.

Cloud effective temperature is the equivalent blackbody temperature of the cloud as seen from above. The temperature of the cloud generally decreases with increasing (decreasing) height (pressure). Thus, the radiation intensity from different layers of a cloud varies with temperature. An integration of that radiation over the cloud thickness, including the attentuation of radiation from lower parts of the cloud by the upper layers, defines the effective temperature. That temperature corresponds to some location between the cloud base and top. Cloud retrieval obtains cloud effective temperature for each pixel first by removing the effects of the atmosphere and any contribution of the surface to the observed 10.8-μm radiance and then using the inverse Planck function to convert the adjusted radiance to temperature.

SSF-114j Mean cloud effective height for multilayer

This parameter is a PSF-weighted mean of the effective height values associated with imager pixels which fall within the current CERES FOV and have a cloud at the corresponding single layer/multilayer portion. (km) [0 .. 20]

The bin-averaged values are weighted by the imager pixel fraction of corresponding layer imager pixels to total imager pixels and PSF. If there are no imager pixels with valid cloud effective height values or if the corresponding single layer or both multilayer area percent coverage is set to 0 or CERES default, this variable is set to CERES default.

Cloud retrieval assigns cloud effective height to each cloudy imager pixels by linearly interpolating to the calculated cloud effective temperature for multilayer (See SSF-11) using the temperature and height vertical profiles from reanalysis (MOA).

SSF-114k Mean cloud base pressure for multilayer

This parameter is a PSF-weighted mean of the base pressure values associated with imager pixels which fall within the current CERES FOV and have a cloud at the corresponding single layer/multilayer portion. (hPa) [0 .. 1100].

The bin-averaged values are weighted by the imager pixel fraction of corresponding layer imager pixels to total imager pixels and PSF. If there are no imager pixels with valid cloud base pressure values or if the corresponding single layer or both multilayer area percent coverage is set to 0 or CERES default, this variable is set to CERES default.

Cloud retrieval obtains cloud thickness from the effective temperature and the logarithm of the optical depth for clouds colder than 245 K. For warm clouds (temperature greater than 275 K), the thickness is related to the square root of the optical depth. For clouds between these temperatures, a linear interpolation between the thickness at the two extremes is performed. The minimum cloud thickness is 100 meters. The thickest cloud is limited by the maximum cloud height. Clouds must be a minimum of 100 meters above the surface. The cloud base height is obtained by subtracting the cloud thickness from the cloud height. The cloud bottom pressure is obtained from the cloud base height. Cloud base pressure is not calculated at night.

Table 1.0-14. Multilayer Cloud Footprint Area

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Hourly Size (MB)
SSF-114a (135)	Single layer/multilayer percent coverages	N/A	0 .. 100	n x 4 x 4	4-bytes real	1.6
SSF-114b (136)	Mean visible optical depth for multilayer	N/A	0 .. 400	n x 4 x 4	4-bytes real	1.6
SSF-114c (137)	Mean logarithm of visible optical depth for multilayer	N/A	-6 .. 6	n x 4 x 4	4-bytes real	1.6
SSF-114d (138)	Mean cloud infrared emissivity for multilayer	N/A	0 .. 2	n x 4 x 4	4-bytes real	1.6
SSF-114e (139)	Mean cloud top pressure for multilayer	hPa	0 .. 1100	n x 4 x 4	4-bytes real	1.6
SSF-114f (140)	Mean cloud top temperature for multilayer	K	100 .. 350	n x 4 x 4	4-bytes real	1.6
SSF-114g (141)	Mean cloud top height for multilayer	km	0 .. 20	n x 4 x 4	4-bytes real	1.6
SSF-114h (142)	Mean cloud effective pressure for multilayer	hPa	0 .. 1100	n x 4 x 4	4-bytes real	1.6
SSF-114i (143)	Mean cloud effective temperature for multilayer	K	100 .. 350	n x 4 x 4	4-bytes real	1.6
SSF-114j (144)	Mean cloud effective height for multilayer	km	0 .. 20	n x 4 x 4	4-bytes real	1.6
SSF-114k (145)	Mean cloud base pressure for multilayer	hPa	0 .. 1100	n x 4 x 4	4-bytes real	1.6

Second dimensional index of variable in Tabel 1.0-15.

Wavelength indicated by SSF-115.

Third (or second index)

1. Imager radiance averaged over the entire CERES footprint
2. Imager radiances averaged only along the ground track

Table 1.0-15. Imager radiance along ground track

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Daily Size (MB)
SSF-115 (146)	Imager channel central wavelength	μm	0.4 .. 15.0	n x 5	4-bytes real	1.0
SSF-116 (147)	All subpixel clear area percent coverage	N/A	0 .. 100	n x 2	4-bytes real	0.2
SSF-117 (148)	All subpixel overcast cloud area percent coverage	N/A	0 ..100	n x 2	4-bytes real	0.2
SSF-118 (149)	Mean imager radiances over clear area	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	-1000 .. 1000	n x 2 x 5	4-bytes real	1.0
SSF-119 (150)	Stddev of imager radiances over clear area	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	0 .. 1000	n x 2 x 5	4-bytes real	1.0
SSF-120 (151)	Mean imager radiances over overcast cloud area	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	-1000 .. 1000	n x 2 x 5	4-bytes real	1.0
SSF-121 (152)	Stddev of imager radiances over overcast cloud area	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	0 .. 1000	n x 2 x 5	4-bytes real	1.0
SSF-122 (153)	Mean imager radiances over full CERES FOV	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	-1000 .. 1000	n x 2 x 5	4-bytes real	1.0
SSF-123 (154)	Stddev of imager radiances over full CERES FOV	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	0 .. 1000	n x 2 x 5	4-bytes real	1.0
SSF-126 (155)	Mean imager radiances over cloud layer 1 (no overlap)	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	-1000 .. 1000	n x 2 x 5	4-bytes real	1.0
SSF-127 (156)	Stddev of imager radiances over cloud layer 1 (no overlap)	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	0 .. 1000	n x 2 x 5	4-bytes real	1.0
SSF-128 (157)	Mean imager radiances over cloud layer 2 (no overlap)	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	-1000 .. 1000	n x 2 x 5	4-bytes real	1.0
SSF-129 (158)	Stddev of imager radiances over cloud layer 2 (no overlap)	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	0 .. 1000	n x 2 x 5	4-bytes real	1.0
SSF-130 (159)	Mean imager radiances over cloud layer 1 and 2 overlap	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	-1000 .. 1000	n x 2 x 5	4-bytes real	1.0
SSF-131 (160)	Stddev of imager radiances over cloud layer 1 and 2 overlap	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	0 .. 1000	n x 2 x 5	4-bytes real	1.0
SSF-131a (161)	Additional imager channel central wavelength	μm	0.4 .. 15.0	n x 2 x 7	4-bytes real	1.4
SSF-131b (162)	Additional mean imager radiances over clear area	$W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$	-1000 .. 1000	n x 2 x 7	4-bytes real	1.4

Table 1.0-15. Imager radiance along ground track

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Daily Size (MB)
SSF-131c (163)	Additional stddev of imager radiances over clear area	W m^{-2} sr^{-1} μm^{-1}	0 .. 1000	n x 2 x 7	4-bytes real	1.4
SSF-131d (164)	Additional mean imager radiances over full CERES FOV	W m^{-2} sr^{-1} μm^{-1}	-1000 .. 1000	n x 2 x 7	4-bytes real	1.4
SSF-131e (165)	Additional stddev of imager radiances over full CERES FOV	W m^{-2} sr^{-1} μm^{-1}	0 .. 1000	n x 2 x 7	4-bytes real	1.4

Second index of variables in Table 1.0-16.

1. Properties averaged over the entire CERES footprint
2. Properties averaged only along the ground track

Table 1.0-16. MODIS Land Aerosols

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Daily Size (MB)
SSF-132 (166)	Percentage of CERES FOV with MODIS land aerosol	N/A	0 .. 100	n x 2	2-bytes int	0.1
SSF-133 (167)	PSF-wtd MOD04 cloud fraction land	N/A	0 .. 100	n x 2	2-bytes int	0.1
SSF-134 (168)	PSF-wtd MOD04 aerosol types land	N/A	0 .. 9999	n x 2	4-bytes int	0.2
SSF-135 (169)	PSF-wtd MOD04 optical depth ratio small land	N/A	0.0 .. 1.0	n x 2	4-bytes real	0.2
SSF-136 (170)	PSF-wtd MOD04 corrected optical depth land (0.470)	N/A	0.0 .. 5.0	n x 2	4-bytes real	0.2
SSF-137 (171)	PSF-wtd MOD04 corrected optical depth land (0.550)	N/A	0.0 .. 5.0	n x 2	4-bytes real	0.2
SSF-138 (172)	PSF-wtd MOD04 corrected optical depth land (0.659)	N/A	0.0 .. 5.0	n x 2	4-bytes real	0.2
SSF-139 (173)	MOD04 number pixels used land (0.659) in CERES FOV	N/A	0 .. (2^{31}-1)	n x 2	4-bytes int	0.2
SSF-140 (174)	PSF-wtd MOD04 mean reflectance land (0.470)	N/A	0.0 .. 1.0	n x 2	4-bytes real	0.2
SSF-141 (175)	PSF-wtd MOD04 mean reflectance land (0.659)	N/A	0.0 .. 1.0	n x 2	4-bytes real	0.2

SSF-142 (176)	PSF-wtd MOD04 mean reflectance land (0.865)	N/A	0.0 .. 1.0	n x 2	4-bytes real	0.2
SSF-143 (177)	PSF-wtd MOD04 mean reflectance land (2.130)	N/A	0.0 .. 1.0	n x 2	4-bytes real	0.2
SSF-144 (178)	PSF-wtd MOD04 mean reflectance land (0.55)	N/A	0.0 .. 1.0	n x 2	4-bytes real	0.2
SSF-145 (179)	PSF-wtd MOD04 std reflectance land (0.470)	N/A	0.0 .. 2.0	n x 2	4-bytes real	0.2

Table 1.0-17. MODIS Ocean Aerosols

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Daily Size (MB)
SSF-146 (180)	Percentage of CERES FOV with MODIS ocean aerosol	N/A	0 .. 100	n x 2	2-bytes int	0.1
SSF-147 (181)	PSF-wtd MOD04 cloud fraction ocean	N/A	0 .. 100	n x 2	2-bytes int	0.1
SSF-148 (182)	PSF-wtd MOD04 solution indices ocean small, average	N/A	0 .. 99999	n x 2	4-bytes int	0.2
SSF-149 (183)	PSF-wtd MOD04 solution indices ocean large, average	N/A	0 .. 99999	n x 2	4-bytes int	0.2
SSF-150 (184)	PSF-wtd MOD04 effective optical depth average ocean (0.470)	N/A	0.0 .. 5.0	n x 2	4-bytes real	0.2
SSF-151 (185)	PSF-wtd MOD04 effective optical depth average ocean (0.550)	N/A	0.0 .. 5.0	n x 2	4-bytes real	0.2
SSF-152 (186)	PSF-wtd MOD04 effective optical depth average ocean (0.659)	N/A	0.0 .. 5.0	n x 2	4-bytes real	0.2
SSF-153 (187)	PSF-wtd MOD04 effective optical depth average ocean (0.865)	N/A	0.0 .. 5.0	n x 2	4-bytes real	0.2
SSF-154 (188)	PSF-wtd MOD04 effective optical depth average ocean (1.240)	N/A	0.0 .. 5.0	n x 2	4-bytes real	0.2
SSF-155 (189)	PSF-wtd MOD04 effective optical depth average ocean (1.640)	N/A	0.0 .. 5.0	n x 2	4-bytes real	0.2
SSF-156 (190)	PSF-wtd MOD04 effective optical depth average ocean (2.130)	N/A	0.0 .. 5.0	n x 2	4-bytes real	0.2
SSF-157 (191)	PSF-wtd MOD04 optical depth small average ocean (0.550)	N/A	0.0 .. 5.0	n x 2	4-bytes real	0.2
SSF-158 (192)	PSF-wtd MOD04 optical depth small average ocean (0.865)	N/A	0.0 .. 5.0	n x 2	4-bytes real	0.2
SSF-159 (193)	PSF-wtd MOD04 optical depth small average ocean (2.130)	N/A	0.0 .. 5.0	n x 2	4-bytes real	0.2

Table 1.0-17. MODIS Ocean Aerosols

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Daily Size (MB)
SSF-160 (194)	PSF-wtd MOD04 cloud condensation nuclei ocean, average	CCN cm^{-2}	0.0 .. $1*10^{10}$	n x 2	4-bytes real	0.2
SSF-161 (195)	PSF-wtd MOD04 mean reflectance ocean (0.470)	N/A	0.0 .. 1.0	n x 2	4-bytes real	0.2
SSF-162 (196)	PSF-wtd MOD04 mean reflectance ocean (0.555)	N/A	0.0 .. 1.0	n x 2	4-bytes real	0.2
SSF-163 (197)	PSF-wtd MOD04 mean reflectance ocean (0.659)	N/A	0.0 .. 1.0	n x 2	4-bytes real	0.2
SSF-164 (198)	PSF-wtd MOD04 mean reflectance ocean (0.865)	N/A	0.0 .. 1.0	n x 2	4-bytes real	0.2
SSF-165 (199)	PSF-wtd MOD04 mean reflectance ocean (1.240)	N/A	0.0 .. 1.0	n x 2	4-bytes real	0.2
SSF-166 (200)	PSF-wtd MOD04 mean reflectance ocean (1.640)	N/A	0.0 .. 1.0	n x 2	4-bytes real	0.2
SSF-167 (201)	PSF-wtd MOD04 mean reflectance ocean (2.130)	N/A	0.0 .. 1.0	n x 2	4-bytes real	0.2

Table 1.0-18. CERES Surface Map

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Daily Size (MB)
SSF-24 (24)	Altitude of surface above sea level	m	-1000 .. 10000	n x 2	4-bytes real	0.1
SSF-25 (25)	Surface type index	N/A	1 .. 20	n x 2 x 8	2-bytes int	0.4
SSF-26 (26)	Surface type percent coverage	N/A	0 .. 100	n x 2 x 8	2-bytes int	0.4

Table 1.0-19. Surface Type

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Daily Size (MB)

SSF-27 (27)	CERES SW ADM type for inversion process	N/A	0 .. 5000	n	2-bytes int	0.05
SSF-28 (28)	CERES LW ADM type for inversion process	N/A	0 .. 5000	n	2-bytes int	0.05
SSF-29 (29)	Cloud Classification	N/A	0 .. 32766	n	2-bytes int	0.05
SSF-30 (30)	Snow/ice percent coverage clear-sky overhead-sun vis albedo	N/A	0 .. 9999	n	2-bytes int	0.05

Table 1.0-20. Filtered Radiances

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Daily Size (MB)
SSF-31 (31)	CERES TOT filtered radiance - upwards	W m^{-2} sr^{-1}	0 .. 700	n	4-bytes real	0.1
SSF-32 (32)	CERES SW filtered radiance - upwards	W m^{-2} sr^{-1}	-10 .. 510	n	4-bytes real	0.1
SSF-33 (33)	CERES WN filtered radiance - upwards	W m^{-2} sr^{-1} μm^{-1}	0 .. 15	n	4-bytes real	0.1
SSF-34 (34)	Radiance and Mode flags	N/A	0 .. $(2^{31}-1)$	n	4-bytes int	0.1

Table 1.0-21. Unfiltered Radiances

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Daily Size (MB)
SSF-35 (35)	CERES SW radiance - upwards	W m^{-2} sr^{-1}	-10 ..510	n	4-bytes real	0.1
SSF-36 (36)	CERES LW radiance - upwards	W m^{-2} sr^{-1}	0 .. 200	n	4-bytes real	0.1
SSF-37 (37)	CERES WN radiance - upwards	W m^{-2} sr^{-1}	0 .. 60	n	4-bytes real	0.1

Table 1.0-22. TOA and Surface Fluxes

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Daily Size (MB)

Table 1.0-22. TOA and Surface Fluxes

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Daily Size (MB)
SSF-41 (42)	CERES downward SW surface flux - Model A	W m^{-2}	0 .. 1400	n	4-bytes real	0.1
SSF-42 (43)	CERES downward LW surface flux - Model A	W m^{-2}	0 .. 700	n	4-bytes real	0.1
SSF-43 (44)	CERES downward WN surface flux - Model A	W m^{-2}	0 .. 250	n	4-bytes real	0.1
SSF-44 (45)	CERES net SW surface flux - Model A	W m^{-2}	0 .. 1400	n	4-bytes real	0.1
SSF-45 (46)	CERES net LW surface flux - Model A	W m^{-2}	-250 .. 50	n	4-bytes real	0.1
SSF-46 (47)	CERES downward SW surface flux - Model B	W m^{-2}	0 .. 1400	n	4-bytes real	0.1
SSF-46a (48)	CERES downward SW surface flux - Model B, clearsky	W m^{-2}	0 .. 1400	n	4-bytes real	0.1
SSF-47 (49)	CERES downward LW surface flux - Model B	W m^{-2}	0 .. 700	n	4-bytes real	0.1
SSF-47a (50)	CERES downward LW surface flux - Model B, clearsky	W m^{-2}	0 .. 700	n	4-bytes real	0.1
SSF-48 (51)	CERES net SW surface flux - Model B	W m^{-2}	0 .. 1400	n	4-bytes real	0.1
SSF-49 (52)	CERES net LW surface flux - Model B	W m^{-2}	-250 .. 50	n	4-bytes real	0.1
SSF-49a (53)	CERES downward LW surface flux - Model C	W m^{-2}	0 .. 700	n	4-bytes real	0.1
SSF-49b (54)	CERES downward LW surface flux - Model C, clearsky	W m^{-2}	0 .. 700	n	4-bytes real	0.1
SSF-49c (55)	CERES net LW surface flux - Model C	W m^{-2}	-250 .. 50	n	4-bytes real	0.1
SSF-50 (56)	CERES broadband surface albedo	N/A	0 .. 1	n	4-bytes real	0.1
SSF-51 (57)	CERES LW surface emissivity	N/A	0 .. 1	n	4-bytes real	0.1
SSF-52 (58)	CERES WN surface emissivity	N/A	0 .. 1	n	4-bytes real	0.1

Table 1.0-23. Full Footprint Area

Item	SDS Name (Variable Name)	Units	Range	Dimen-sions	Data Type	Maximum Daily Size (MB)
SSF-53 (59)	Number of imager pixels in CERES FOV	N/A	0 .. 32766	n x 2	2-bytes int	0.05
SSF-54 (60)	Imager percent coverage	N/A	0 .. 100	n x 2	2-bytes int	0.05
SSF-55 (61)	Imager viewing zenith over CERES FOV	deg	0 .. 90	n	4-bytes real	0.1
SSF-56 (62)	Imager relative azimuth over CERES FOV	deg	0 .. 360	n	4-bytes real	0.1
SSF-57 (63)	Surface wind - U-vector	m sec^{-1}	-100 .. 100	n	4-bytes real	0.1
SSF-58 (64)	Surface wind - V-vector	m sec^{-1}	-100 .. 100	n	4-bytes real	0.1
SSF-59 (65)	Surface skin temperature	K	175 .. 375	n	4-bytes real	0.1
SSF-59a (66)	Surface pressure	hPa	0 .. 1100	n	4-bytes real	0.1
SSF-60 (67)	Column averaged relative humidity	N/A	0 .. 100	n	4-bytes real	0.1
SSF-60a (68)	Surface minus 750 mb air temperature difference	K	-200 .. 200	n	4-bytes real	0.1
SSF-60b (69)	Estimated Inversion Stability	K	-200 .. 200	n	4-bytes real	0.1
SSF-61 (70)	Precipitable water	cm	0.001 .. 10	n	4-bytes real	0.1
SSF-62 (71)	Flag - Source of precipitable water	N/A	0 .. 120	n	2-bytes int	0.05
SSF-63 (72)	Cloud property extrapolation over cloudy area	N/A	0 .. 100	n	2-bytes int	0.05
SSF-64 (73)	Notes on general procedure	N/A	0 .. 32766	n	2-bytes int	0.05
SSF-65 (74)	Notes on cloud algorithms	N/A	0 .. 32766	n	2-bytes int	0.05
SSF-65a (75)	Additional notes on cloud algorithms	N/A	0 .. 32766	n	2-bytes int	0.05
SSF-65b (76)	Notes on cloud multilayer	N/A	0 .. 32766	n	2-bytes int	0.05

Variables extracted from standard CERES CRS

Table 1.0-24. Surface Radiative Properties

SARB SDS	Terra and Aqua CRS SDS Number[a]	SDS Name	Units	Range	Dim	Data Type	Maximum Daily Size (MB)
1 (202)	Aqua-161	Photosynthetically active radiation over surface	W m^{-2}	0 .. 780	n	4-bytes real	0.1
2 (203)	Aqua-162	Direct/diffuse surface ratio	N/A	0 .. 30	n	4-bytes real	0.1
3 (204)	Terra-163	Corrected initial broadband surface albedo	N/A	0 .. 1	n	4-bytes real	0.1

a. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

Table 1.0-25. Vertical Profile Description

SARB SDS	Terra and Aqua CRS SDS Number[a]	SDS Name	Units	Range	Dim	Data Type	Maximum Daily Size (MB)
4 (205)	Terra-164	Number of atmospheric levels	N/A	0 .. 5	n	4-bytes int	0.1
5 (206)	Terra-165	Pressure levels	hPa	0 .. 1100	n x 5	4-bytes real	0.1

a. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

Table 1.0-26. Pristine Vertical Flux Profiles

SARB SDS	Terra and Aqua CRS SDS Number[a]	SDS Name	Units	Range	Dim	Data Type	Maximum Daily Size (MB)
6 (207)	Terra-166	SW flux - upward - pristine	W m^{-2}	0 .. 1400	n x 2	4-bytes real	0.2
7 (208)	Terra-167	SW flux - downward - pristine	W m^{-2}	0 .. 1400	n x 2	4-bytes real	0.2
8 (209)	Terra-168	LW flux - upward - pristine	W m^{-2}	0 .. 850	n x 2	4-bytes real	0.2
9 (210)	Terra-169	LW flux - downward - pristine	W m^{-2}	0 .. 700	n x 2	4-bytes real	0.2
10 (211)	Terra-170	WN flux - upward - pristine	W m^{-2}	0 .. 370	n x 2	4-bytes real	0.2
11 (212)	Terra-171	WN flux - downward - pristine	W m^{-2}	0 .. 370	n x 2	4-bytes real	0.2

Second dimensional index 1 = TOA, 2 = surface.

a. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

The second dimensional index of variable in tables 1.0-29 and 1.0-30
1 = TOA
2 = 70 hPa
3 = 200 hPa
4 = 500 hPa
5 = Surface

Table 1.0-27. Constrained Clear Sky Profiles

SARB SDS	Terra and Aqua CRS SDS Number[a]	SDS Name	Units	Range	Dim	Data Type	Maximum Daily Size (MB)
12 (213)	Terra-172	SW flux - upward for clear-sky	W m^{-2}	0 .. 1400	n x 5	4-bytes real	0.5
13 (214)	Terra-173	SW flux - downward for clear-sky	W m^{-2}	0 .. 1400	n x 5	4-bytes real	0.5
14 (215)	Terra-174	LW flux - upward for clear-sky	W m^{-2}	0 .. 850	n x 5	4-bytes real	0.5
15 (216)	Terra-175	LW flux - downward for clear-sky	W m^{-2}	0 .. 700	n x 5	4-bytes real	0.5
16 (217)	Terra-176	WN flux - upward for clear-sky	W m^{-2}	0 .. 370	n x 5	4-bytes real	0.5
17 (218)	Terra-177	WN flux - downward for clear-sky	W m^{-2}	0 .. 370	n x 5	4-bytes real	0.5

a. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

Table 1.0-28. Constrained Total Sky Profiles

SARB SDS	Terra and Aqua CRS SDS Number[a]	SDS Name	Units	Range	Dim	Data Type	Maximum Daily Size (MB)
18 (219)	Terra-178	SW flux - upward for total-sky	W m^{-2}	0 .. 1400	n x 5	4-bytes real	0.5
19 (220)	Terra-179	SW flux - downward for total-sky	W m^{-2}	0 .. 1400	n x 5	4-bytes real	0.5
20 (221)	Terra-180	LW flux - upward for total-sky	W m^{-2}	0 .. 850	n x 5	4-bytes real	0.5
21 (222)	Terra-181	LW flux - downward for total-sky	W m^{-2}	0 .. 700	n x 5	4-bytes real	0.5
22 (223)	Terra-182	WN flux - upward for total-sky	W m^{-2}	0 .. 370	n x 5	4-bytes real	0.5
23 (224)	Terra-183	WN flux - downward for total-sky	W m^{-2}	0 .. 370	n x 5	4-bytes real	0.5

a. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

Adjustment in Tables1.0-31, 1.0-32, and 1.0-33 are defined as
Untune irradiance = Tuned irradiance – adjustment.

Table 1.0-29. Pristine Constrainment-Initial Flux Deltas

SARB SDS	Terra and Aqua CRS SDS Number[a]	SDS Name	Units	Range	Dim	Data Type	Maximum Daily Size (MB)
24 (225)	Terra-184	SW flux adjustment at surface - upward - pristine	W m^{-2}	-1400 .. 1400	n	4-bytes real	0.1
25 (226)	Terra-185	SW flux adjustment at TOA - upward - pristine	W m^{-2}	-1400 .. 1400	n	4-bytes real	0.1
26 (227)	Terra-186	SW flux adjustment at surface - downward - pristine	W m^{-2}	-1400 .. 1400	n	4-bytes real	0.1
27 (228)	Terra-187	LW flux adjustment at surface - upward - pristine	W m^{-2}	-600 .. 600	n	4-bytes real	0.1
28 (229)	Terra-188	LW flux adjustment at surface - downward - pristine	W m^{-2}	-700 .. 700	n	4-bytes real	0.1
29 (230)	Terra-189	LW flux adjustment at TOA - upward - pristine	W m^{-2}	-700 .. 700	n	4-bytes real	0.1
30 (231)	Terra-190	WN flux adjustment at surface - upward - pristine	W m^{-2}	-50 .. 50	n	4-bytes real	0.1
31 (232)	Terra-191	WN flux adjustment at surface - downward - pristine	W m^{-2}	-50 .. 50	n	4-bytes real	0.1
32 (233)	Terra-192	WN flux adjustment at TOA - upward - pristine	W m^{-2}	-50 .. 50	n	4-bytes real	0.1

a. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

Table 1.0-30. Clear Sky Constrainment-Initial Flux Deltas

SARB SDS	Terra and Aqua CRS SDS Number[a]	SDS Name	Units	Range	Dim	Data Type	Maximum Daily Size (MB)
33 (234)	Terra-193	SW flux adjustment at surface - upward for clear-sky	W m^{-2}	-1400 .. 1400	n	4-bytes real	0.1
34 (235)	Terra-194	SW flux adjustment at TOA - upward for clear-sky	W m^{-2}	-1400 .. 1400	n	4-bytes real	0.1
35 (236)	Terra-195	SW flux adjustment at surface - downward for clear-sky	W m^{-2}	-1400 .. 1400	n	4-bytes real	0.1
36 (237)	Terra-196	LW flux adjustment at surface - upward for clear-sky	W m^{-2}	-600 .. 600	n	4-bytes real	0.1
37 (238)	Terra-197	LW flux adjustment at surface - downward for clear-sky	W m^{-2}	-700 .. 700	n	4-bytes real	0.1
38 (239)	Terra-198	LW flux adjustment at TOA - upward for clear-sky	W m^{-2}	-700 .. 700	n	4-bytes real	0.1
39 (240)	Terra-199	WN flux adjustment at surface - upward for clear-sky	W m^{-2}	-50 .. 50	n	4-bytes real	0.1
40 (241)	Terra-200	WN flux adjustment at surface - downward for clear-sky	W m^{-2}	-50 .. 50	n	4-bytes real	0.1

41 (242)	Terra-201	WN flux adjustment at TOA - upward for clear-sky	W m^{-2}	-50 .. 50	n	4-bytes real	0.1

a. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

Table 1.0-31. Total Sky Constrainment-Initial Flux Deltas

SARB SDS	Terra and Aqua CRS SDS Number[a.]	SDS Name	Units	Range	Dim	Data Type	Maximum Daily Size (MB)
42 (243)	Terra-202	SW flux adjustment at surface - upward for total-sky	W m^{-2}	-1400 .. 1400	n	4-bytes real	0.1
43 (244)	Terra-203	SW flux adjustment at TOA - upward for total-sky	W m^{-2}	-1400 .. 1400	n	4-bytes real	0.1
44 (245)	Terra-204	SW flux adjustment at surface - downward for total-sky	W m^{-2}	-1400 .. 1400	n	4-bytes real	0.1
45 (246)	Terra-205	LW flux adjustment at surface - upward for total-sky	W m^{-2}	-600 .. 600	n	4-bytes real	0.1
46 (247)	Terra-206	LW flux adjustment at surface - downward for total-sky	W m^{-2}	-700 .. 700	n	4-bytes real	0.1
47 (248)	Terra-207	LW flux adjustment at TOA - upward for total-sky	W m^{-2}	-700 .. 700	n	4-bytes real	0.1
48 (249)	Terra-208	WN flux adjustment at surface - upward for total-sky	W m^{-2}	-50 .. 50	n	4-bytes real	0.1
49 (250)	Terra-209	WN flux adjustment at surface - downward for total-sky	W m^{-2}	-50 .. 50	n	4-bytes real	0.1
50 (251)	Terra-210	WN flux adjustment at TOA - upward for total-sky	W m^{-2}	-50 .. 50	n	4-bytes real	0.1

a. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

Table 1.0-32. Satellite Emulated Window Channel

SARB SDS	Terra and Aqua CRS SDS Number[a]	SDS Name	Units	Range	Dim	Data Type	Maximum Daily Size (MB)
51 (252)	Terra-211	WN filtered radiance -satellite emulated	W $m^{-2}sr^{-1}$	0 .. 50	n	4-bytes real	0.1
52 (253)	Terra-212	WN filtered radiance adjustment-satellite emulated	W $m^{-2}sr^{-1}$	0 .. 50	n	4-bytes real	0.1
53 (254)	Terra-213	WN flux - satellite emulated - TOA	W m^{-2}	2 .. 50	n	4-bytes real	0.1
54 (255)	Terra-214	WN flux adjustment - satellite emulated - TOA	W m^{-2}	2 .. 50	n	4-bytes real	0.1

a. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

Table 1.0-33. Unfiltered Total Longwave

SARB SDS	Terra and Aqua CRS SDS Number[a]	SDS Name	Units	Range	Dim	Data Type	Maximum Daily Size (MB)

55 (256)	Terra-215	Total LW unfiltered radiance - satellite emulated	W $m^{-2}sr^{-1}$	0 .. 200	n	4-bytes real	0.1
56 (257)	Terra-216	Total LW unfiltered radiance adjustment - satellite emulated	W $m^{-2}sr^{-1}$	0 .. 200	n	4-bytes real	0.1

a. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

Table 1.0-34. Constrainment Adjustments

SARB SDS	Terra and Aqua CRS SDS Number[a]	SDS Name	Units	Range	Dim	Data Type	Maximum Daily Size (MB)
57 (258)	Terra-217	Total column precipitable water - initial	cm	0 .. 10	n	4-bytes real	0.1
58 (259)	Terra-218	Total column precipitable water - adjustment	cm	-10 .. 10	n	4-bytes real	0.1
59 (260)	Terra-219	Upper tropospheric precipitable water - initial	cm	0 .. 10	n	4-bytes real	0.1
60 (261)	Terra-220	Upper tropospheric precipitable water - adjustment	cm	-10 .. 10	n	4-bytes real	0.1
61 (262)	Terra-221	Upper tropospheric humidity - initial	N/A	0.0 .. 100.0	n	4-bytes real	0.1
62 (263)	Terra-222	Upper tropospheric humidity - adjustment	N/A	0.0 .. 100.0	n	4-bytes real	0.1
63 (264)	Terra-223	Surface albedo - adjustment	N/A	-1 ..1	n	4-bytes real	0.1
64 (265)	Terra-224	Aerosol optical depth - initial	N/A	0 .. 2	n	4-bytes real	0.1
65 (266)	Terra-225	Aerosol optical depth - adjustment	N/A	-2 .. 2	n	4-bytes real	0.1
66 (267)	Terra-226	Skin temperature - initial	K	TBD	n	4-bytes real	0.1
67 (268)	Terra-227	Skin temperature - adjustment	K	TBD	n	4-bytes real	0.1
68 (269)	Terra-228	Mean visible optical depth- adjustment	N/A	-400 .. 400	n x 2	4-bytes real	0.2
69 (270)	Terra-229	Mean cloud fractional area - adjustment	N/A	-1 .. 1	n x 2	4-bytes real	0.2
70 (271)	Terra-230	Mean cloud effective temperature - adjustment	K	TBD	n x 2	4-bytes real	0.2

a. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

Table 1.0-35. Aerosol Constituency Information

SARB SDS	Terra and Aqua CRS SDS Number[a]	SDS Name	Units	Range	Dim	Data Type	Maximum Daily Size (MB)
71 (272)	Terra-231	Aerosol constituency flags	N/A	01000000 .. 18999999	n x 7	4-bytes int	0.7

72 (273)	Terra-232	Aerosol and surface albedo sources flag	N/A	100 - 303	n	4-bytes int	0.1

a. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

Table 1.0-36. Constrainment Status

SARB SDS	Terra and Aqua CRS SDS Number[a]	SDS Name	Units	Range	Dim	Data Type	Maximum Daily Size (MB)
73 (274)	Terra-233	Number of tuning iterations	N/A	0 .. 1	n	4-bytes int	0.1
74 (275)	Terra-234	Constrainment status flag	N/A	0 .. 600	n	4-bytes int	0.1
75 (276)	Terra-235	FuLiou model error code	N/A	1 .. 3000	n	4-bytes int	0.1

a. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

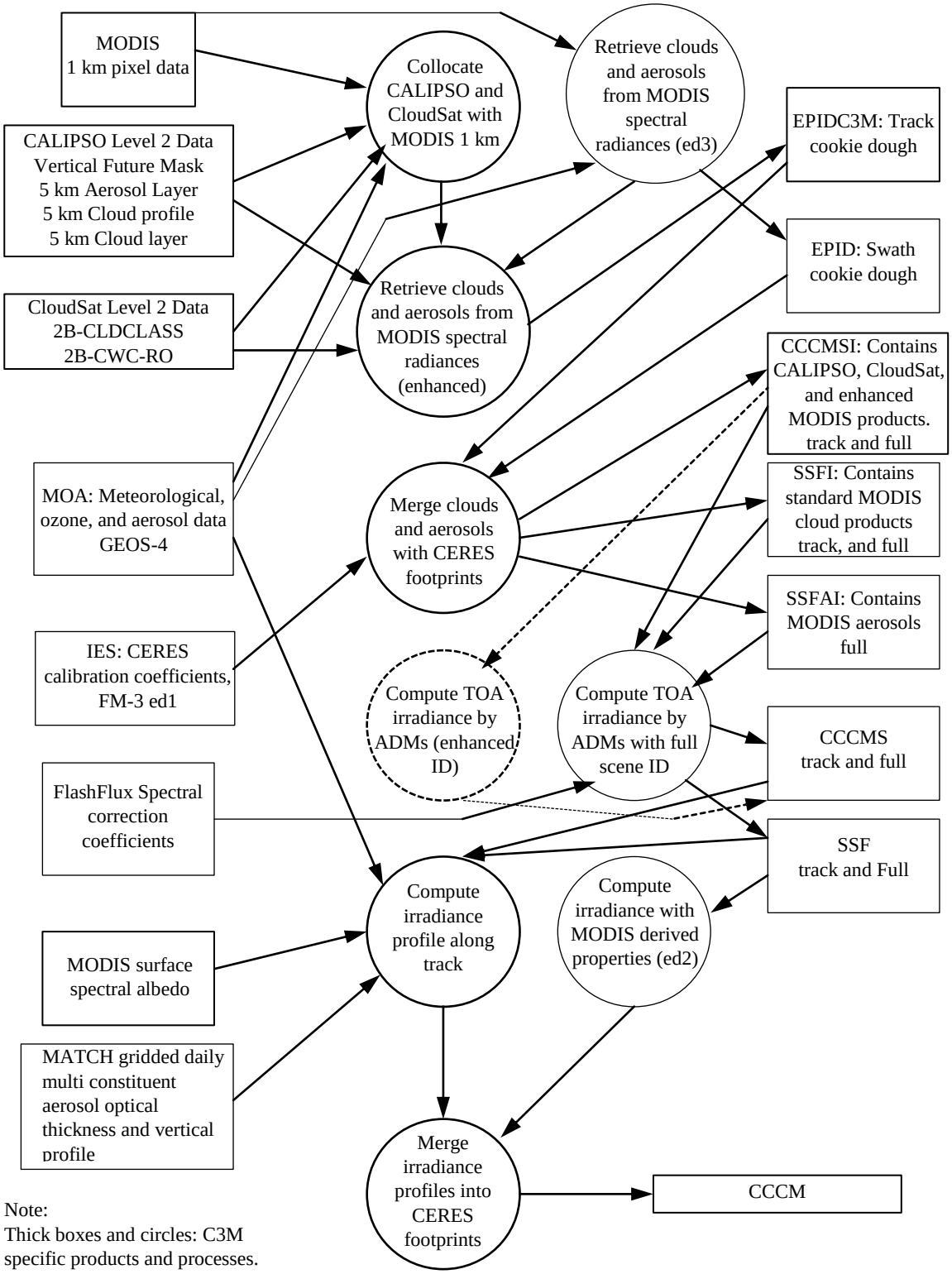
Table 1.0-37. Cloudy Skies with No Aerosol Information

SARB SDS	Terra and Aqua CRS SDS Number[a]	SDS Name	Units	Range	Dim	Data Type	Maximum Daily Size (MB)
76 (277)	Terra-236	SW flux - upward - cloudy skies with no aerosol	W m^{-2}	0 .. 1400	n	4-bytes real	0.1
77 (278)	Terra-237	SW flux - downward - cloudy skies with no aerosol	W m^{-2}	0 .. 1400	n	4-bytes real	0.1
78 (279)	Terra-238	LW flux - upward - cloudy skies with no aerosol	W m^{-2}	0 .. 850	n	4-bytes real	0.1
79 (280)	Terra-239	LW flux - downward - cloudy skies with no aerosol	W m^{-2}	0 .. 700	n	4-bytes real	0.1
80 (281)	Terra-240	WN flux - upward - cloudy skies with no aerosol	W m^{-2}	0 .. 370	n	4-bytes real	0.1
81 (282)	Terra-241	WN flux - downward - cloudy skies with no aerosol	W m^{-2}	0 .. 370	n	4-bytes real	0.1
82 (283)	Terra-242	SW flux adjustment at surface - upward - cloudy skies with no aerosol	W m^{-2}	-1400 .. 1400	n	4-bytes real	0.1
83 (284)	Terra-243	SW flux adjustment at TOA - upward - cloudy skies with no aerosol	W m^{-2}	-1400 .. 1400	n	4-bytes real	0.1
84 (285)	Terra-244	SW flux adjustment at surface - downward - cloudy skies with no aerosol	W m^{-2}	-1400 .. 1400	n	4-bytes real	0.1
85 (286)	Terra-245	LW flux adjustment at surface - upward - cloudy skies with no aerosol	W m^{-2}	-600 .. 600	n	4-bytes real	0.1
86 (287)	Terra-246	LW flux adjustment at surface - downward - cloudy skies with no aerosol	W m^{-2}	-700 .. 700	n	4-bytes real	0.1
87 (288)	Terra-247	LW flux adjustment at TOA - upward - cloudy skies with no aerosol	W m^{-2}	-700 .. 700	n	4-bytes real	0.1
88 (289)	Terra-248	WN flux adjustment at surface - upward - cloudy skies with no aerosol	W m^{-2}	-50 .. 50	n	4-bytes real	0.1

89 (290)	Terra-249	WN flux adjustment at surface - downward - cloudy skies with no aerosol	W m^{-2}	-50 .. 50	n	4-bytes real	0.1
90 (291)	Terra-250	WN flux adjustment at TOA - upward - cloudy skies with no aerosol	W m^{-2}	-50 .. 50	n	4-bytes real	0.1

a. The first 160 Terra and Aqua CRS SDSs are listed in the corresponding SSF DPC pages.

Estimated MegaBytes / Day:	**CCCM cloud and aerosols variables**	**379**
	CCCM flux variables	**340**
	Standard SSF+CRS nadir view only	



Note:
Thick boxes and circles: C3M specific products and processes.
Thin boxes and circles: CERES standard products and processes.
Dashed lines: Future processes.